Los Alamos National Laboratory earns three R&D 100 awards

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LOS ALAMOS, New Mexico, June 22, 2011—Los Alamos National Laboratory scientists have won three of R&D Magazine's 2011 R&D100 Awards. Recognized as the "Oscars of Invention" by the Chicago Tribune, these awards honor the top 100 proven technological advances of the past year. The winning Laboratory technologies include a molecular beacon that targets specific nucleic acids, a spacer fluid for oil wells that shrinks when heated, and a better way to produce thorium, an elemental sustainable energy source.

"I want to congratulate this year's R&D 100 award winners," said Energy Secretary Steven Chu. "The Department of Energy's national laboratories and sites are at the forefront of innovation, and it is gratifying to see their work recognized once again. The cutting-edge research and development done in our national labs and facilities is helping to meet our energy challenges, strengthen our national security, and enhance our economic competitiveness."

"Once again the RD 100 awards show that Los Alamos National Laboratory's multidisciplinary scientific approach provides real-world innovation with the potential to drive job creation in the private sector while delivering benefits to the American public," said LANL Director Charlie McMillan. "We are proud of our Los Alamos researchers, and I salute them all as well as the researchers from our sister labs and facilities who won R&D 100 Awards as well."

This year's winning technologies include:

NanoCluster Beacons

NanoCluster Beacons are collections of silver atoms designed to illuminate when bound to nucleic acids, such as the DNA of specific pathogens. Created by Hsin-Chih (Tim) Yeh, James Werner, Jaswinder Sharma, and Jennifer Martinez, these beacons can be used to probe for diseases that threaten humans by identifying the nucleic acid targets that represent a person's full genome, and allow for personalized medication. They can also be used in quantitative biology applications, such as counting individual molecules inside a cell.

Once bound with a specific target, a NanoCluster Beacon lights up, emitting fluorescence approximately 200 times greater than in the unbound state and easily viewed by the naked eye under ultraviolet light. The beacons come in an array of colors for multiplexed analyses, are more photostable than beacons used today, and can be turned on and off reversibly. Inexpensive, easy to use, and reversible, NanoCluster Beacons are superior molecular probes for detecting specific targets, human oncogene (cancer) sequences, and molecular disease sequences such as sickle cell anemia.

Revolutionizing Deepwater Oil-Well Drilling

TAPSS, or Trapped Annular Pressure Shrinking Spacer, is a spacer fluid developed by Robert Hermes of LANL, in collaboration with Chevron Energy Technology Company, Baker Hughes Incorporated's Drilling Fluids Unit, and Lucite International Ltd., to help prevent catastrophes in offshore oil-well drilling. Conventional spacer fluids are placed between oil well casings to secure the well and balance the pressure exerted by the surrounding geological formations. Most of these fluids expand when heated during drilling, causing potential pressure build ups and disastrous oil spills. TAPSS, on the other hand, shrinks when heated and can be used to offset any thermal expansion from the other fluids. TAPSS is formulated with enough methyl methacrylate to counteract the expansion of conventional spacer fluids. This new spacer is not difficult to use, is self-functioning, and requires minimal time to install.

TAPSS can be applied to any well around the world and will continue to work for the full life of the well, making it both effective and practical.

Thorium Is Now Green

Th-ING was developed by Jaqueline Kiplinger and Thibault Cantat as a straightforward, cost-effective, and safe method to produce thorium. Thorium is an element capable of producing more energy than both uranium and coal using significantly lower quantities. This element is only slightly radioactive, making it an excellent candidate for a future sustainable energy source. It is so safe that it will never lead to a nuclear meltdown when used in a nuclear reactor.

Before Th-ING, thorium could only be produced in hazardous settings at unreasonably high prices. This new method involves reacting thorium nitrate with aqueous hydrochloric acid under mild conditions, which can be performed using conventional glassware in a traditional laboratory setting. Then, a novel combination of anhydrous hydrochloric acid and trimethylsilyl chloride is used to remove coordinated water molecules, replacing them with dimethoxyethane to make the new thorium chloride reagent. The process cuts costs of production from $5,000 per kilogram to a mere $30 per kilogram and is "green"—as it does not produce wasteful solvent ring-opening/ polymerization or waste thorium (95 percent production yields). With Th-ING, thorium becomes a practical and reliable source of energy for the future.

Three Decades of Excellence in Innovation

Since 1978, Los Alamos has won 121 of the prestigious R&D100 Awards in R&D Magazine's global competition involving industry, academia, and government-sponsored research. Winners include innovative new materials, chemistry breakthroughs, consumer items, testing equipment, manufacturing advances, high-energy physics, and biomedical products.